—研究ノート—
Scientific Note

Magnetic survey in Ongul Strait, Lützow-Holm Bay, East Antarctica

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東南極，リュツォ・ホルム湾，オングル海峡の地磁気探査

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要旨： 第35次南極地域観測において，東南極，リュツォ・ホルム湾，オングル海峡で地磁気全磁力測定を行った．オングル海峡では，南北および北北西－南南東走行の地磁気異常が観測された．オングル海峡の南西部以外では，負の地磁気異常が卓越する．また，地磁気異常は，約 -100 nT から 80 nT の間で変化している．

***Abstract*:** Measurements of total intensity of the geomagnetic field were carried out during the 35th Japanese Antarctic Research Expedition (JARE-35) in Ongul Strait, Lützow-Holm Bay, East Antarctica. N-S and NNW-SSE striking magnetic anomalies are observed in Ongul Strait. Negative magnetic anomalies are dominant except for the southwestern part of Ongul Strait. Magnetic anomalies vary from about −100 nT to 80 nT.

1. Introduction

Magnetic anomalies obtained by near-surface magnetic survey are related to the magnetic properties of surface rocks and topographical features. The magnetic properties of surface rocks often reflect surface geology. Magnetic anomalies obtained by near-surface survey are used to speculate on geological structures in an area where surface geology is unknown, such as an area covered by ice.

Ongul Strait is located between the Sôya Coast and the Ongul Islands, in Lützow-Holm Bay, East Queen Maud Land, Antarctica (Fig. 1). Magnetic anomalies had never been obtained in Ongul Strait, though those on the Ongul Islands have been well reported. Observations of magnetic anomalies on East and West Ongul Islands, Lützow-Holm Bay, have been reported by Nikki *et al.* (1981), Oowada (1987) and Nogi *et al.* (1991). Large magnetic anomalies of more than 300 nT are observed in the western part of East Ongul Island, and no noticeable magnetic anomalies in the eastern part (Oowada, 1987). These anomaly patterns are roughly parallel to the surface geological trend on East Ongul Island (Oowada, 1987). Nogi *et al.* (1991) also suggest that the variations of magnetic anomalies in the eastern part of West Ongul Island correlate well with the surface geology.

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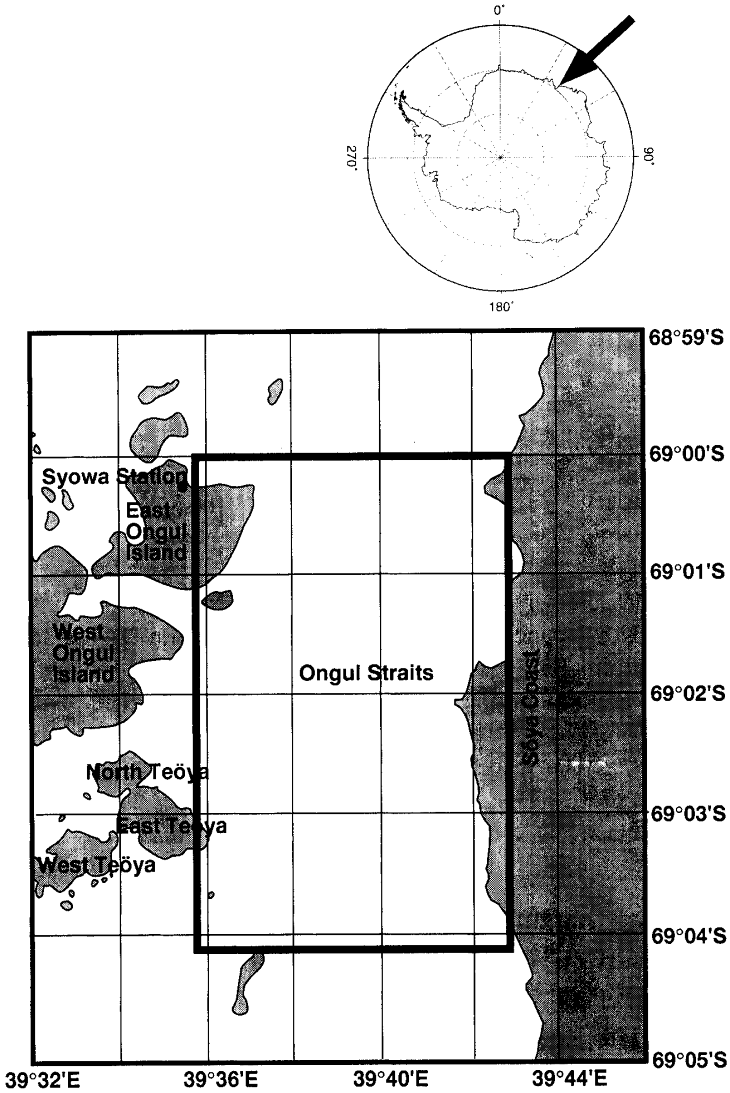

Fig. 1. Location of Ongul Strait, Lützow-Holm Bay, East Antarctica. The box is the study area.

Measurements of total intensities of the geomagnetic field were carried out in Ongul Strait in August and November 1994, during JARE-35. To our knowledge, these are the first such data from Ongul Strait. In this paper, we report the results of magnetic anomalies in Ongul Strait. The study area is shown in Fig. 1.

2. Observation and data processing

The measurements of total intensity of the geomagnetic field were conducted at about 200 m intervals along the ten east-west oriented observation lines. Spacing of the ten east-west oriented observation lines is about 0.5′ in the latitudinal direction (about 900 m). The locations of the observation points were determined by a global positioning system receiver (GPS). The GPS location error suggested by the manufacturer is about 100 m in

Fig. 2. Distribution of the observation points (shaded circles) and color image of magnetic anomalies in Ongul Strait. The color scale is shown in the upper center. The contour interval is 10 nT. Solid and broken lines show positive and negative magnetic anomalies respectively.

the horizontal plane. The observation points are shown in Fig. 2. Some observation points are slightly shifted from the east-west observation lines due to icebergs. The survey in the northern part of the study area was performed on August 8th and that in the rest of the study area from November 8th to 13th, 1994.

The total intensity of the geomagnetic field was measured at 2 m height above the sea ice surface using a portable proton magnetometer. The magnetometer sensor was installed about 50 m apart from the snow vehicle at the observation points. The total intensity of the geomagnetic field was obtained at intervals of 10 s during 1–5 min at each observation point and stored in the magnetometer memory.

A stationary geomagnetic field observation point was also installed at Syowa Station, East Ongul Island, during the observation in Ongul Strait to correct the time variations of the geomagnetic field. The sampling interval at the stationary observation point was 1

Table 1. Magnetic anomalies at observation points.

Latitude (degree)	Longitude (degree)	MA (nT)	SD (nT)	Latitude (degree)	Longitude (degree)	MA (nT)	SD (nT)
-69.00019	39.59409	-102.91	0.43	-69.01375	39.65992	-89.93	2.32
-68.99997	39.60039	-140.53	0.55	-69.01322	39.66531	-94.98	0.74
-69.00028	39.60450	-16.08	0.24	-69.01400	39.67089	-101.47	2.17
-69.00039	39.60920	7.10	0.30	-69.01361	39.67639	-105.31	5.85
-69.00058	39.61539	1.88	0.21	-69.01367	39.68064	-104.77	0.74
-69.00097	39.62020	-47.11	0.39	-69.01319	39.68567	-96.11	4.00
-69.00119	39.62620	-54.76	0.38	-69.01361	39.68925	-93.91	4.27
-69.00047	39.63139	-89.04	0.20	-69.01294	39.69653	-96.43	5.51
-69.00028	39.63578	-90.01	0.35	-69.01308	39.70242	-97.08	4.28
-69.00047	39.64078	-95.58	0.42	-69.01311	39.70517	-83.39	1.73
-69.00097	39.64628	-112.05	0.32	-69.01439	39.71031	-112.22	5.64
-69.00097	39.65120	-131.79	0.31	-69.01328	39.71534	-161.16	3.60
-69.00078	39.65570	-146.91	0.18	-69.02203	39.71025	-83.37	2.99
-69.00078	39.66139	-158.25	0.26	-69.02297	39.70345	-113.69	1.76
-69.00069	39.66678	-164.34	0.27	-69.02225	39.69789	-82.16	3.32
-69.00047	39.67328	-166.96	0.13	-69.02069	39.69470	-74.21	2.03
-69.00028	39.67970	-158.09	0.34	-69.02281	39.68764	-75.85	1.52
-69.00047	39.68470	-145.92	0.38	-69.02325	39.68239	-57.84	5.57
-69.00058	39.68889	-133.64	1.19	-69.02306	39.67770	-61.73	3.04
-69.00039	39.69500	-126.86	0.18	-69.02297	39.67175	-58.74	2.55
-69.00019	39.69928	-111.69	0.46	-69.02253	39.66642	-53.34	3.00
-69.00517	39.62481	-13.50	0.50	-69.02303	39.66242	-51.27	4.97
-69.00594	39.62973	-33.05	0.56	-69.02239	39.65786	-47.78	2.96
-69.00550	39.63459	-50.56	0.57	-69.02194	39.65306	-40.55	2.32
-69.00558	39.63953	-66.86	0.37	-69.02300	39.64711	-31.01	3.07
-69.00550	39.64373	-79.30	0.72	-69.02467	39.64161	-16.35	1.47
-69.00583	39.64853	-92.94	0.77	-69.02317	39.63695	-6.55	3.18
-69.00578	39.65345	-105.11	0.92	-69.02331	39.63173	2.28	3.19
-69.00525	39.65884	-116.11	0.50	-69.02319	39.62611	10.58	2.02
-69.00525	39.66417	-123.79	0.45	-69.02228	39.62214	6.71	1.65
-69.00514	39.66950	-130.96	1.87	-69.02306	39.61611	-2.88	0.98
-69.00617	39.67500	-128.63	0.71	-69.02347	39.61070	3.50	2.98
-69.00578	39.67950	-127.40	0.59	-69.02908	39.60970	-39.45	3.00
-69.00542	39.68473	-124.74	0.98	-69.03039	39.61634	-2.06	2.12
-69.00544	39.68984	-115.25	0.87	-69.03061	39.62206	2.77	2.84
-69.00533	39.69606	-120.05	1.83	-69.03025	39.62686	-3.58	3.97
-69.00547	39.70011	-102.14	0.85	-69.03036	39.63170	0.38	2.40
-69.00475	39.70478	-113.15	3.37	-69.03036	39.63670	-6.09	0.79
-69.01303	39.61417	4.15	0.60	-69.03003	39.64250	-14.06	1.54
-69.01389	39.62209	-0.34	0.58	-69.03047	39.64570	-28.07	0.69
-69.01419	39.62534	0.04	0.83	-69.03083	39.65461	-40.32	3.01
-69.01386	39.62898	-4.67	0.67	-69.03072	39.65734	-45.37	2.66
-69.01353	39.63361	-14.04	0.62	-69.03122	39.66275	-43.39	5.56
-69.01403	39.64045	-31.70	1.02	-69.03011	39.66903	-47.22	3.80
-69.01333	39.64406	-46.82	0.59	-69.03025	39.67373	-45.48	1.67
-69.01433	39.64989	-63.85	0.65	-69.03025	39.67809	-49.65	20.22
-69.01347	39.65536	-77.70	1.50	-69.03033	39.68303	-36.99	4.31

MA and SD are magnetic anomaly and standard deviation respectively.

Table 1 (continued).

Latitude (degree)	Longitude (degree)	MA (nT)	SD (nT)	Latitude (degree)	Longitude (degree)	MA (nT)	SD (nT)
-69.03006	39.68825	-41.15	8.52	-69.05444	39.62942	35.80	0.44
-69.03022	39.69431	-49.77	10.51	-69.05422	39.62414	54.80	0.34
-69.03011	39.69906	-23.26	11.57	-69.05392	39.61650	41.79	1.28
-69.03878	39.69445	-21.72	7.47	-69.05419	39.61028	-27.95	1.32
-69.03867	39.68914	-32.15	2.63	-69.05439	39.60428	-33.76	1.58
-69.03842	39.68417	-42.20	4.79	-69.06308	39.59345	-38.77	2.56
-69.03881	39.67931	-48.98	3.51	-69.06414	39.59875	-23.80	0.52
-69.03886	39.67353	-21.67	5.31	-69.06319	39.60434	-60.91	1.21
-69.03889	39.66906	-31.67	4.62	-69.06317	39.61009	-35.92	0.94
-69.03861	39.66373	-46.24	4.32	-69.06289	39.62167	18.09	2.60
-69.03850	39.66067	-46.60	1.60	-69.06281	39.62136	16.62	0.93
-69.03875	39.65350	-34.59	0.43	-69.06289	39.62653	82.54	0.33
-69.03861	39.64781	-17.84	1.19	-69.06328	39.63248	69.33	0.87
-69.03844	39.64164	-4.07	2.89	-69.06336	39.63775	50.85	0.77
-69.03881	39.63692	-0.86	1.84	-69.06264	39.64170	32.94	3.63
-69.03917	39.63028	-5.34	3.66	-69.06125	39.64798	9.93	0.83
-69.03889	39.62467	-13.04	1.76	-69.06178	39.65223	-9.80	0.56
-69.03867	39.62017	-41.34	3.76	-69.06222	39.65639	-17.32	1.90
-69.03889	39.61311	-57.07	0.99	-69.06258	39.66220	-17.05	3.30
-69.04703	39.61420	41.86	2.91	-69.06219	39.66795	-19.55	2.18
-69.04694	39.62009	6.67	2.19	-69.06256	39.67195	-21.49	2.50
-69.04681	39.62481	-2.32	0.83	-69.06286	39.67667	-30.61	4.09
-69.04697	39.62911	5.55	0.84	-69.06231	39.68206	-31.78	2.72
-69.04689	39.63606	20.51	1.80	-69.06167	39.68767	-29.13	3.26
-69.04603	39.64173	39.52	2.75	-69.06189	39.69389	-22.23	3.16
-69.04617	39.64620	31.54	1.21	-69.06161	39.69725	-19.61	2.07
-69.04669	39.65309	9.11	0.39	-69.07036	39.70575	-26.08	3.19
-69.04636	39.65867	-17.69	1.90	-69.07033	39.70042	-43.09	3.03
-69.04561	39.66542	-32.66	0.88	-69.07061	39.69478	-52.98	2.44
-69.04569	39.67314	-32.70	1.88	-69.07031	39.68981	-49.30	3.94
-69.04578	39.67809	-24.06	1.37	-69.07008	39.68386	-47.13	3.40
-69.04508	39.68448	-32.42	1.90	-69.07044	39.67903	-29.06	2.00
-69.04594	39.69039	-48.49	1.45	-69.07042	39.67411	-12.98	3.02
-69.04525	39.69670	-18.55	2.85	-69.07092	39.66900	0.93	1.01
-69.05481	39.70228	-45.78	2.09	-69.06939	39.66498	8.14	1.57
-69.05453	39.69764	-46.64	2.14	-69.06886	39.66000	-5.55	2.20
-69.05478	39.69178	-21.40	1.21	-69.06908	39.65453	-19.37	1.20
-69.05481	39.68531	-13.84	1.15	-69.06906	39.64998	-21.16	1.66
-69.05447	39.68017	-24.82	1.40	-69.06919	39.64445	-0.94	1.96
-69.05464	39.67534	-26.56	2.82	-69.06911	39.63634	89.41	2.37
-69.05494	39.66828	-23.22	0.95	-69.06928	39.63142	39.67	3.33
-69.05439	39.66184	-12.35	2.04	-69.06956	39.62623	-45.70	2.21
-69.05319	39.65870	-9.71	3.08				
-69.05447	39.65023	-7.20	2.09				
-69.05417	39.64478	14.23	1.26				
-69.05422	39.64064	37.95	0.84				
-69.05486	39.63431	41.38	0.54				

MA and SD are magnetic anomaly and standard deviation respectively.

min. The average magnitude of the geomagnetic field at Syowa Station is about 43600 nT and the inclination is about $-64°$ (upward).

Total intensity magnetic data obtained in Ongul Strait were transmitted from the magnetometer memory to a personal computer and averaged at each observation point. First, corrections for the time variations of the geomagnetic field were made using the time series geomagnetic field data observed at the stationary observation point at Syowa Station. Then, the magnetic anomalies at observation points in Ongul Strait were obtained by subtracting the IGRF-90 field (IAGA Division V, Working Group 8, 1991) from the observed data.

3. Results

Magnetic anomalies at observation points are listed in Table 1. A contour map of the magnetic anomalies in Ongul Strait was produced by GMT software (Wessel and Smith, 1991) based on the observed magnetic anomalies (Fig. 2).

N-S and NNW-SSE striking magnetic anomalies are observed in the study area. Negative magnetic anomalies are dominant except in the southwest. The peaks of negative magnetic anomalies are about -100 nT. In the southwestern part of the study area, positive magnetic anomalies are observed and their maximum amplitude is about 80 nT.

4. Concluding remarks

Total intensities of the geomagnetic field were obtained for the first time in Ongul Strait. N-S and NNW-SSE striking magnetic anomalies are observed in the study area. The magnetic anomalies are possibly caused by surface rock magnetic properties and topographic features, and deeper structures are of secondary importance. Some magnetic anomaly trends seem different from submarine topographic trends. These may reflect change in surface rock magnetic properties related to lithological change, although the basement topography is unknown. The origin of the magnetic anomalies in the study area cannot be specified in the present state. Further survey is required for more detailed discussion. Magnetic modeling using observed magnetic anomalies will help to understand the structures beneath Ongul Strait.

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